

## **Dorsey, Nancy**

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**From:** Dorsey, Nancy  
**Sent:** Tuesday, September 06, 2016 12:28 PM  
**To:** Elizabeth Cochran  
**Subject:** Re: Fwd: OKLAHOMA SEISMICITY CONFERENCE CALL (10:30 A.M.)

Thanks Elizabeth!

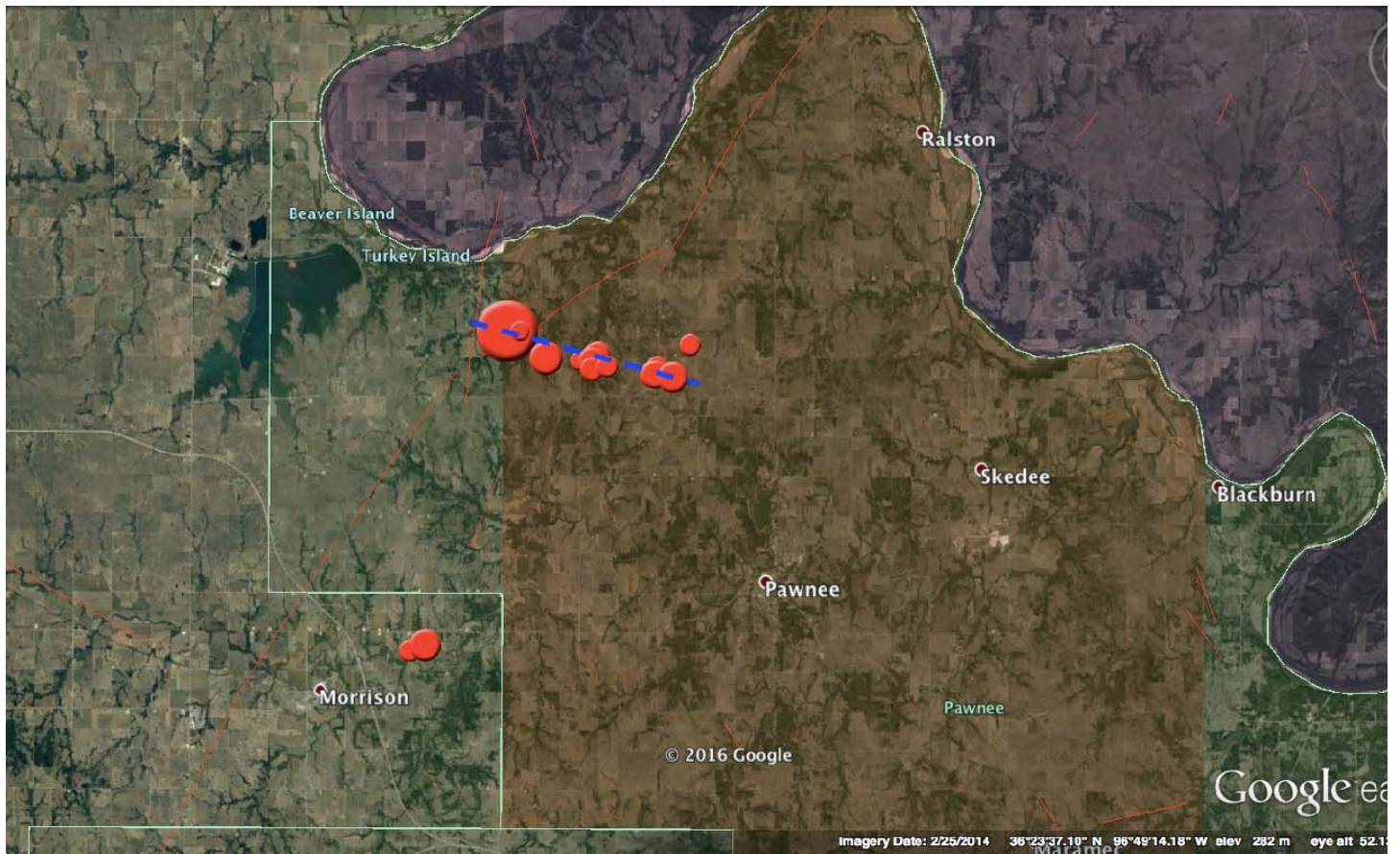
Nancy

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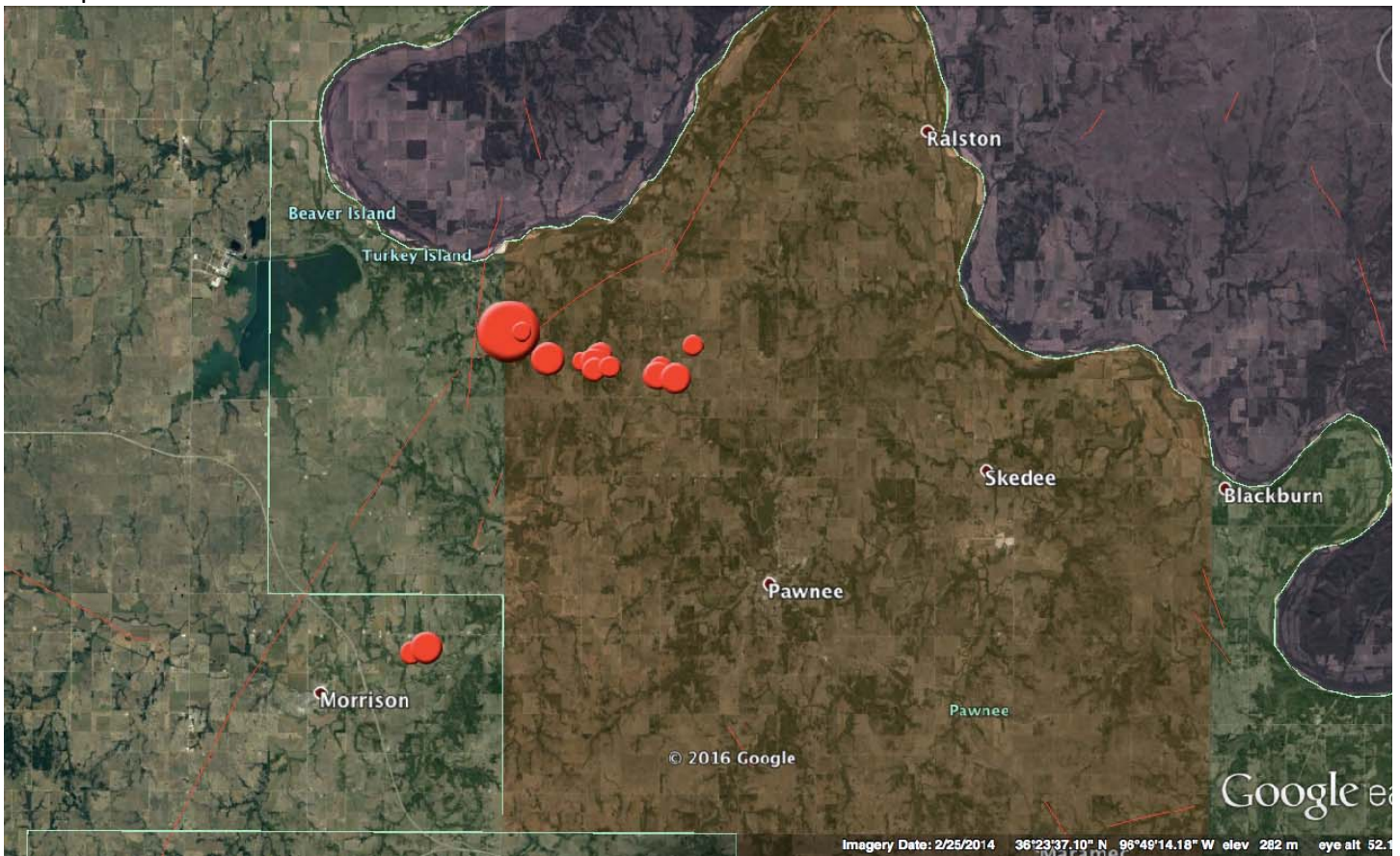
**From:** Elizabeth Cochran <ecochran@usgs.gov>  
**Sent:** Tuesday, September 6, 2016 12:06 PM  
**To:** Berry, Natalie  
**Cc:** mary.hale@bia.gov; robin.phillips@bia.gov; lee.burnett@bia.gov; eddie.streater@bia.gov; wandrews@usgs.gov; hickman@usgs.gov; rawilliams@usgs.gov; applegate@usgs.gov; Dellinger, Philip; Coleman, Sam; Dorsey, Nancy; Mike Blanpied; Justin Rubinstein  
**Subject:** Re: Fwd: OKLAHOMA SEISMICITY CONFERENCE CALL (10:30 A.M.)

All,

The figure below shows the faults in the OGS database (thin red lines) as well as the mainshocks and relocated aftershocks (red dots) for the Pawnee earthquake sequence; also shown is the approximate orientation of the fault that slipped in the Pawnee event (dashed blue line). The azimuth of the blue line (~110-120 degrees) is well-oriented for failure from what we know about the orientation of the regional stress field (70-90 degrees).



Here is the same map without the estimated fault orientation of the Pawnee earthquake:



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Elizabeth Cochran, Ph.D.  
Research Geophysicist, U.S. Geological Survey  
Visiting Associate, Caltech  
525 S. Wilson Ave  
Pasadena, CA 91106  
<https://profile.usgs.gov/ecochran>



## USGS Professional Pages - Elizabeth Cochran

[profile.usgs.gov](https://profile.usgs.gov)

Contact Information Elizabeth Cochran 525 535 South  
Wilson Street Pasadena, CA 91106 [ecochran@usgs.gov](mailto:ecochran@usgs.gov) 626-  
583-7238 626-583-7827 - Fax Back to top

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Ph: (626) 583-7238





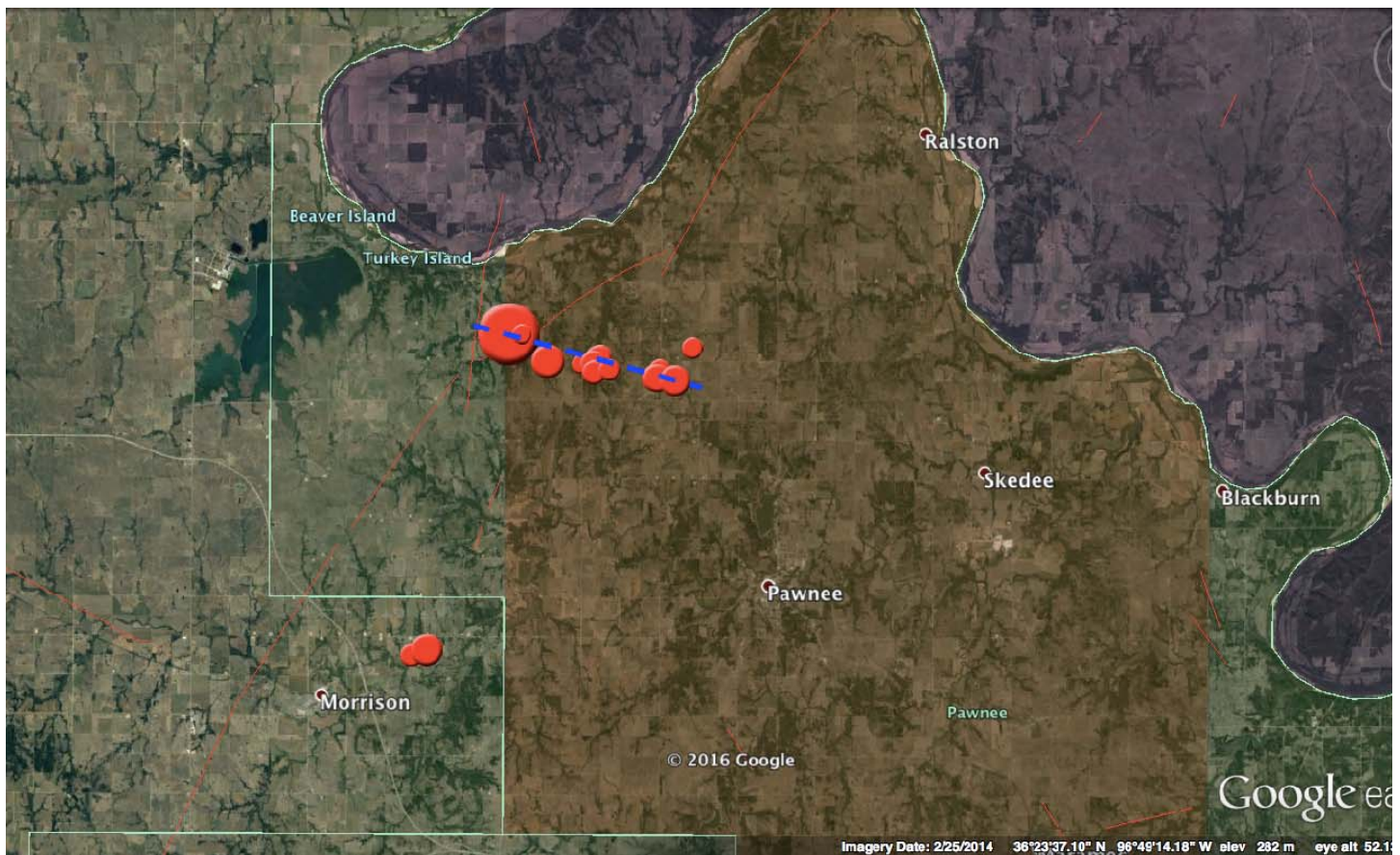
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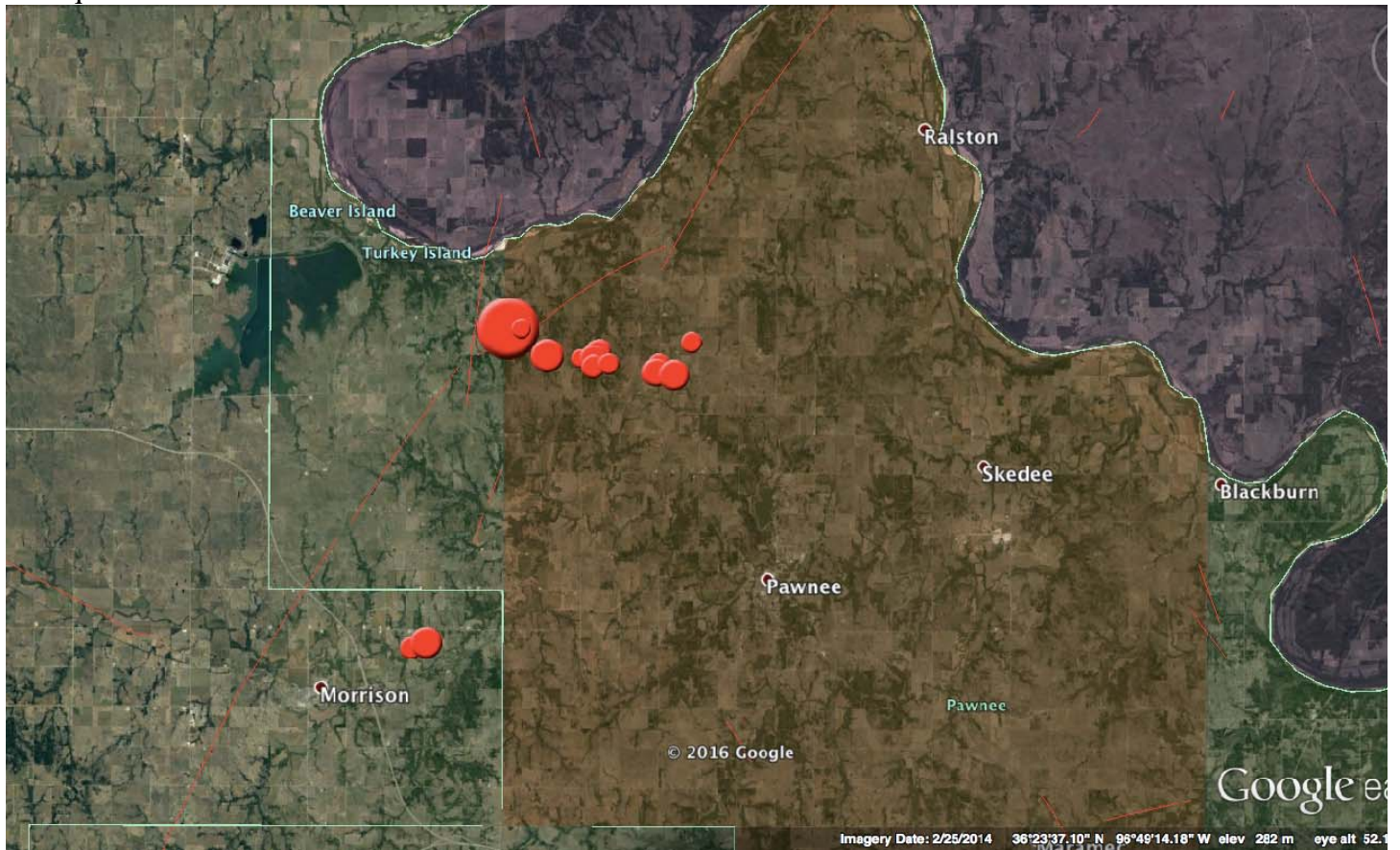
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Pasadena, CA 91106  
<https://profile.usgs.gov/ecochran>  
Ph: (626) 583-7238

## Dorsey, Nancy

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**From:** Dellinger, Philip  
**Sent:** Monday, September 05, 2016 3:38 PM  
**To:** William S Leith; Coleman, Sam; Dorsey, Nancy  
**Cc:** William Andrews; Steve Hickman; Robert A Williams; David Applegate; mary.hale@bia.gov  
**Subject:** RE: earthquake update

Thanks Bill. In terms of expertise, I recommend someone knowledgeable on the Oklahoma hazard analysis and stress regime, as well as the relocation of events in the state. We are looking at 10:30 tomorrow morning and someone in our office will send you the particulars tomorrow morning.

Philip Dellinger, Chief  
Ground Water/UIC Section  
EPA Region 6, Dallas, TX  
214-665-8324

---

**From:** William S Leith [mailto:wleith@usgs.gov]  
**Sent:** Monday, September 05, 2016 1:49 PM  
**To:** Coleman, Sam <Coleman.Sam@epa.gov>; Dellinger, Philip <dellinger.philip@epa.gov>; Dorsey, Nancy <Dorsey.Nancy@epa.gov>  
**Cc:** William Andrews <wandrews@usgs.gov>; Steve Hickman <hickman@usgs.gov>; Robert A Williams <rawilliams@usgs.gov>; David Applegate <applegate@usgs.gov>; mary.hale@bia.gov  
**Subject:** Fwd: earthquake update  
**Importance:** High

EPA colleagues,

If you do organize a coordination call and want USGS participation, please just let us know the particulars and we will be sure to have someone (or more) join the call. Be sure to let us know what USGS information or expertise you seek.

The USGS, the Oklahoma Geological Survey, and university researchers are in the process of putting seismometers out to record aftershocks, which will help better delineate the causative fault. Right now, none of the USGS seismometers will be on tribal land (I can't speak for OGS or others).

Please also note that the earthquake may gain some additional importance and public visibility if the USGS revises its magnitude estimate to M5.7, which would make it the largest recorded earthquake in Oklahoma. We will be making a decision on that possible magnitude change tomorrow.

With regards,

—Bill

William Leith, Ph.D.  
Senior Science Advisor for Earthquake  
and Geologic Hazards  
U.S. Geological Survey  
905 National Center, Reston VA 20192  
tel 703-648-6786



On Sep 3, 2016, at 8:51 PM, Mary Hale <[mary.hale@bia.gov](mailto:mary.hale@bia.gov)> wrote:

EPA would like to coordinate a call with federal partners asap regarding UIC disposal wells in Osage County, seeking expertise as to any possible relationship to recent seismic events and relevant legal authorities of the federal partners. They would like to have the call before Tuesday if possible.

If needed, I will go to the office on Monday to set up a conference call.

Jeannine

Sent from my iPhone

Begin forwarded message:

**From:** "Coleman, Sam" <[Coleman.Sam@epa.gov](mailto:Coleman.Sam@epa.gov)>  
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**Cc:** "Honker, William" <[honker.william@epa.gov](mailto:honker.william@epa.gov)>, "Gray, David" <[gray.david@epa.gov](mailto:gray.david@epa.gov)>, "Curry, Ron" <[Curry.Ron@epa.gov](mailto:Curry.Ron@epa.gov)>, "Blevins, John" <[Blevins.John@epa.gov](mailto:Blevins.John@epa.gov)>, "Edlund, Carl" <[Edlund.Carl@epa.gov](mailto:Edlund.Carl@epa.gov)>, "Gilrein, Stephen" <[gilrein.stephen@epa.gov](mailto:gilrein.stephen@epa.gov)>, "Coleman, Sam" <[Coleman.Sam@epa.gov](mailto:Coleman.Sam@epa.gov)>  
**Subject:** Fwd: earthquake update

Please see below. We would like to schedule a call as soon as possible to discuss how we can best work together to address the situation and its relationship to Osage County. Specifically we are interested in technical resources that BIA might have access to such as USGS or BOEM experts on seismicity. We have records on the UIC program that can be made available as needed.

I appreciate your willingness to help coordinate with Superintendent Streeter.

Please let me know via cell when we can get our respective teams together.

Samuel Coleman, P. E.,  
Deputy Regional Administrator

214.665.2100 Ofc  
214.665. 3110 Desk  
214.665.2016 Cell

[Coleman.sam@epa.gov](mailto:Coleman.sam@epa.gov)

Sent from my iPhone



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**From:** "Coleman, Sam" <[Coleman.Sam@epa.gov](mailto:Coleman.Sam@epa.gov)>  
**Date:** September 3, 2016 at 4:45:29 PM CDT  
**To:** "Honker, William" <[honker.william@epa.gov](mailto:honker.william@epa.gov)>, "Payne, James" <[payne.james@epa.gov](mailto:payne.james@epa.gov)>, "Blevins, John" <[Blevins.John@epa.gov](mailto:Blevins.John@epa.gov)>, "Blanco, Arturo" <[Blanco.Arturo@epa.gov](mailto:Blanco.Arturo@epa.gov)>, "Gilrein, Stephen" <[gilrein.stephen@epa.gov](mailto:gilrein.stephen@epa.gov)>, "Curry, Ron" <[Curry.Ron@epa.gov](mailto:Curry.Ron@epa.gov)>, "Gray, David" <[gray.david@epa.gov](mailto:gray.david@epa.gov)>  
**Subject:** Fwd: earthquake update

We will need clarity on who and how are can take any appropriate actions on Osage Nation. This might include orders or other directives. If these should come from BIA or from the Osage Tribe needs to be determined. We also will need to assure that appropriate technical support is coordinated with all involved with UIC program.

We will need to have a call with BIA as soon as possible to coordinate our actions. Who has best contact with BIA and can arrange a call?

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Below is the media advisory on OCC's action. Attached is a map of the area, part of which extends into Osage County. OCC has targeted 37 wells in the state jurisdiction area. Nancy Dorsey and Bill Hurlbut are in the office inventorying wells in this area. Nancy just reported there are 4 Osage Arbuckle disposal wells in the 5 mile perimeter extending into Osage County and 9 in the 10 mile for a total of thirteen wells under EPA jurisdiction. She is tabulating the key info for these wells.

-----Original Message-----

From: Dorsey, Nancy  
Sent: Saturday, September 03, 2016 3:00 PM  
To: Dellinger, Philip <[dellinger.philip@epa.gov](mailto:dellinger.philip@epa.gov)>  
Subject: FW: earthquake update  
Importance: High

-----Original Message-----

From: Matt Skinner  
[<mailto:M.Skinner@occemail.com>]  
Sent: Saturday, September 03, 2016 2:59 PM  
To: Matt Skinner <[M.Skinner@occemail.com](mailto:M.Skinner@occemail.com)>  
Subject: FW: earthquake update

Media Advisory  
Oklahoma Corporation Commission  
Matt Skinner - Public Information Director  
405-521-4180

9/3

The Oklahoma Corporation Commission's Oil and Gas Division (OGCD) is in the process of implementing a mandatory directive to shut down all Arbuckle disposal wells within a 725 square mile area, based on the location of the earthquake that occurred shortly after 7 a.m. on September 3, 2016 near Pawnee. The area includes 211 square miles of Osage County, which is outside of OGCD jurisdiction. OGCD is working with the Environmental Protection Agency, which has sole jurisdiction over disposal wells in Osage County. The EPA will determine what action to take in that area.

The action in the area will involved a total of 37 wells. The schedule for shut down will vary according to the well, but all wells will be shut down within 10 days. The schedule is necessary because of warnings from seismologists that a large scale, sudden shutdown could cause an earthquake.

<AOI\_Pawnee\_09-03-2016\_CL Layout Final.pdf>

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Jill McCarthy  
USGS Hazards Science Center  
MS 966; P.O. Box 25046  
Denver, CO 80225  
303-273-8579

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905 National Center, Reston VA 20192  
tel 703-648-6786  
[if it's really urgent, don't use email]

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"Garcia, David" <[Garcia.David@epa.gov](mailto:Garcia.David@epa.gov)>,  
"Blevins, John" <[Blevins.John@epa.gov](mailto:Blevins.John@epa.gov)>,  
"Saunders, Jerry" <[Saunders.Jerry@epa.gov](mailto:Saunders.Jerry@epa.gov)>,  
"Brown, Jamesr" <[brown.jamesr@epa.gov](mailto:brown.jamesr@epa.gov)>,  
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